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## Pluripotent Stem Cell–Based Therapy for Heart Disease

### Grant Award Details

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Pluripotent Stem Cell–Based Therapy for Heart Disease

**Grant Type:** Disease Team Planning

**Grant Number:** DT1-00671

**Investigator:**

<b>Name:</b>	Deepak Srivastava
<b>Institution:</b>	Gladstone Institutes, J. David
<b>Type:</b>	PI

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**Award Value:** \$13,505

**Status:** Closed

### Grant Application Details

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**Application Title:** Pluripotent Stem Cell–Based Therapy for Heart Disease

**Public Abstract:**

Five million people in the U.S. suffer with heart failure, resulting in ~60,000 deaths/year at a cost of \$30 billion/year. Heart failure occurs when the heart is damaged and becomes unable to meet the demands placed on it. Unlike other organs, the heart is unable to fully repair itself after injury. One of the common causes for the development of heart damage is a heart attack. After a myocardial infarction (heart attack), irreversible loss of contracting heart muscle cells occurs, resulting in scar formation and subsequently heart failure. Current therapies designed to treat heart attack patients in the acute setting include medical therapies and catheter-based technologies that aim to open the blocked coronary arteries with the hope of salvaging as much of the jeopardized heart muscle cells as possible. Unfortunately, despite advances over the past 2 decades, it is rarely possible to rescue the at-risk heart muscle cells from some degree of irreversible injury and death.

Attention has turned to new methods of treating heart attack and heart failure patients in both the acute and chronic settings after their event. Heart transplantation remains the ultimate approach to treating end-stage heart failure patients but this therapy is invasive, costly, some patients are not candidates for transplantation given their other co-morbidities, and most importantly, there are not enough organs for transplanting the increasing number of patients who need this therapy. As such, newer therapies are needed to treat the millions of patients with debilitating heart conditions. Recently, it has been discovered that stem cells may hold therapeutic potential for these patients. Experimental studies in animals have revealed encouraging results when pluripotent stem cells are introduced into the heart around areas of myocardial infarction. These therapies appear to result in improvement in the contractile function of the heart.

However, numerous questions remain unanswered concerning the use of pluripotent stem cells as therapy for patients with heart attack and heart failure. Human embryonic stem (ES) cells and induced pluripotent stem (iPS) cells grow and divide indefinitely while maintaining the potential to develop into many tissues of the body, including heart muscle. They provide an unprecedented opportunity to both study human heart muscle in culture in the laboratory, and advance the possibility of their use in therapy for damaged heart muscle. We have developed methods for identifying and isolating specific types of human ES and iPS cells, stimulating them to become human heart muscle cells, and delivering these into the hearts of rodents that have had a heart attack. This research will refine and advance such approaches in small and large animals, develop clinical grade cells for use, and ultimately initiate clinical trials for patients suffering from heart disease.

**Statement of Benefit to California:**

More than 90,000 people in California suffer with heart failure, at a cost of ~\$540 million/year. Heart failure occurs when the heart is damaged and becomes unable to meet the demands placed on it. Unlike other organs, the heart is unable to fully repair itself after injury. One of the common causes for the development of heart damage is a heart attack. After a myocardial infarction (heart attack), irreversible loss of contracting heart muscle cells occurs, resulting in scar formation and subsequently heart failure. Current therapies designed to treat heart attack patients in the acute setting include medical therapies and catheter-based technologies that aim to open the blocked coronary arteries with the hope of salvaging as much of the jeopardized heart muscle cells as possible. Unfortunately, despite advances over the past 2 decades, it is rarely possible to rescue the at-risk heart muscle cells from some degree of irreversible injury and death. Recently, it has been discovered that stem cells may hold therapeutic potential for these patients. Experimental studies in animals have revealed encouraging results when pluripotent stem cells are introduced into the heart around areas of myocardial infarction. These therapies appear to result in improvement in the contractile function of the heart.

We propose to assemble a disease team focused on using cardiac progenitors derived from pluripotent cells to restore function in patients with ischemic cardiomyopathy. The proposed research will identify human embryonic stem (ES) cells and induced pluripotent stem (iPS) cells that are best able to repair damaged heart muscle, thereby treating heart failure. Human ES and iPS cells grow and divide indefinitely while maintaining the potential to develop into many tissues of the body, including heart muscle. They provide an unprecedented opportunity to both study human heart muscle in culture in the laboratory, and advance the possibility of their use in therapy for damaged heart muscle. In addition to the health benefits to the people of California, and the anticipated savings in health care costs, these studies will lead to therapeutic technologies that could be used by the state and its biopharmaceutical industry to increase its tax base.

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